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DISPERSAL IN A COSMOPOLITAN BUTTERFLY SPECIES (*PIERIS RAPAE*) HAVING OPEN POPULATION STRUCTURE

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THE DISPERSAL BEHAVIOR OF A species is one of the instrumental factors determining the degree of isolation of neighboring populations or subpopulations over an extended area. Species with a low rate of dispersal due to lack of vagility, intrinsic barriers to dispersal, or extrinsic barriers, should tend to have closed population structures promoting a high degree of inbreeding. On the other hand, cosmopolitan butterflies might be frequently expected to show high dispersal capabilities with a corresponding open population structure permitting relatively panmictic gene flow. The present short study tested this concept by assessing dispersal behavior in the common cabbage white butterfly, *Pieris rapae* Linnaeus (Pieridae), at a montane locality in southwestern Virginia.

All field work was done in the Rocky Sink canyon area, 2400 feet elevation, on the southeast side of Johns Creek Mountain (between Newport and Pembroke, northwest of Highway 460), Giles County, Virginia, from July 17 to 21, 1970. Two areas (CENTRAL and LOWER) were established in the main canyon, separated by about 400 meters of suitable habitat, and a third area (UPPER) was delimited in an adjacent side canyon. The UPPER area was separated from the CENTRAL area by a minimum of 250 meters, much of which was forested. Mountain slopes bordered all areas (see Figure 1). Each of the three areas was worked simultaneously by separate teams of four collectors, for 75 minutes during the peak of flight activity (1015-1130 hours EDT). New captures were marked with Magic Marker pens on the underside of the wings in a 1-2-4-7 code system (Ehrlich and Davidson, 1960), using small blue, red, and green dots for the specimens from each area. Releases were made at the end of the marking period each day. Recaptures were recorded by number, sex, and location so as to facilitate evaluation of dispersal rates.

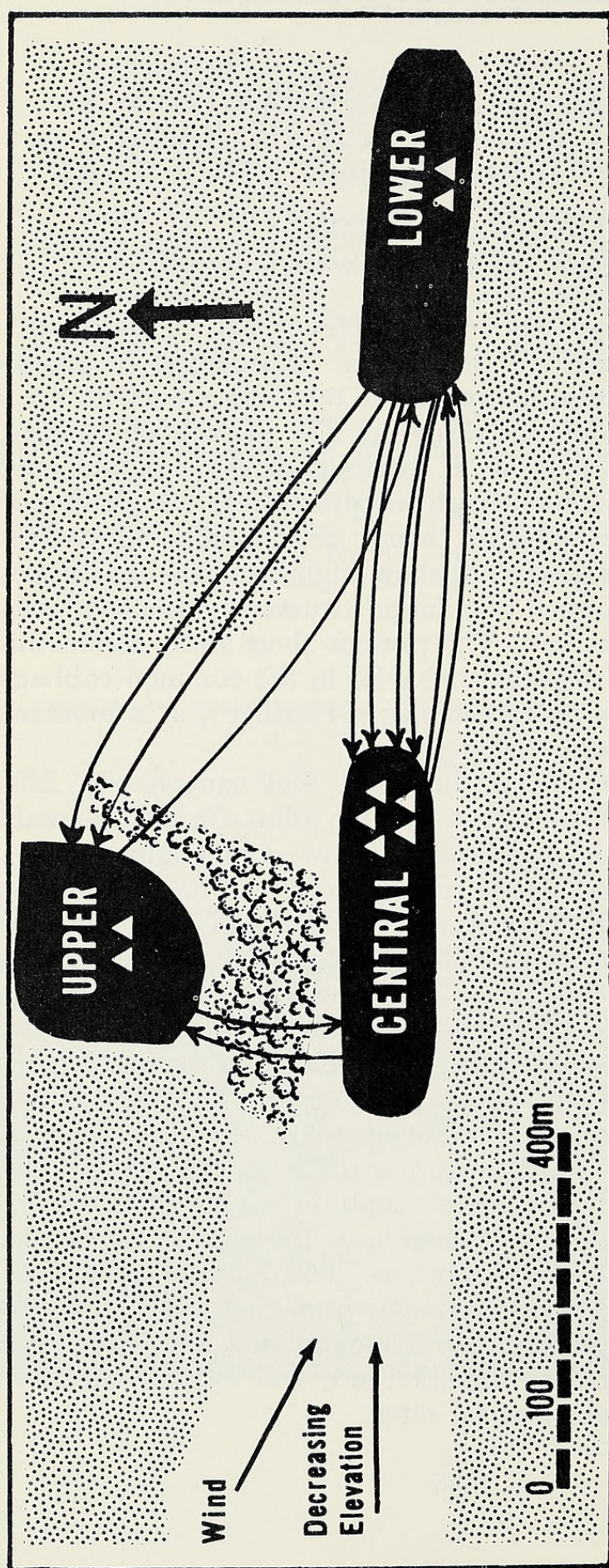


Fig. 1.—Map of three areas used for mark-recapture experiments on *Pieris rapae*: Rocky Sink area, 2400', at junction of unimproved roads 605 and 602, SE side of Johns Creek Mountain, Giles Co., Virginia. U.S. Highway 460 is located about one mile to the south of this study area. The shaded areas represent mountain slopes. A small brook, with bordering wet meadows, flows from left to right in the figure through the main canyon. Arrows between marking areas show known movements of marked individuals as determined by capture and recapture sites. White triangles indicate recaptured specimens that had not moved.

Table 1. Capture-recapture results with Pieris rapae
at Rocky Sink in Giles County, Virginia, 17-21 July 1970.

Area		Day 1	Day 2	Day 3	Total		Comments on Recaptures (see Fig. 1)
		7/17	7/18	7/21	Butterflies (Sex ratio)		
UPPER	New Captures	28	49	36	86 ♂♂ 27 ♀♀		2 ♂♂ stationary 3 ♂♂ known to move in 1 ♂, 1 ♀ known to move out
	Recaptures	--	2	3	(3.19♂: 1.00♀)		
CENTRAL	New Captures	20	24	17	27 ♂♂ 34 ♀♀		2 ♂♂, 3 ♀♀ stationary 3 ♂♂, 2 ♀♀ known to move out 2 ♂♂, 3 ♀♀ known to move in
	Recaptures	--	5	5	(0.79♂: 1.00♀)		
LOWER	New Captures	11	20	31	33 ♂♂ 29 ♀♀		1 ♂, 1 ♀ stationary 2 ♂, 1 ♀ known to move out 2 ♂♂, 1 ♀ known to move in
	Recaptures	--	3	2	(1.14♂: 1.00♀)		

The results are given in Table 1 and the movements of recaptured marked specimens are shown in Figure 1. It is clear that both sexes disperse at the same frequency (per cent of marked population) and that males and females move the same relative distances and compass directions, within the limits of this capture-recapture program. Wind direction and slope may influence movement in that more butterflies moved against the wind and up the slope than down-wind and down-slope. Females occur in highest frequency in the "CENTRAL" area, adjacent to the small stream where oviposition sites are abundant as compared to the drier slopes.

The three delimited areas, despite their separation by physical distance, are not true populations. Instead, the dispersal behavior exhibited by *Pieris rapae* in these experiments and from other observations indicates that a population unit would be very large, diffuse, and hard to define. Panmixis is unquestionably promoted in single-egg-laying species with this type of open population structure. Anecdotal information is available which indicates the presence of this type of population structure in butterflies of several families (e.g., Brower, 1961; Emmel and Emmel, 1962: p. 41-42; Emmel, 1964) and it has recently been analyzed in detail (Brussard and Ehrlich, 1970) for the satyrid butterfly *Erebia epipsodea*.

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